Airborne Raman Ozone, Temperature and Aerosol Lidar (AROTAL)

Instrument: AROTAL
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Goddard's AROTAL lidar is designed to measure three atmospheric components: aerosols, ozone and temperature. The instrument is configured around three key components: a light source, detector assembly and data processing instrumentation.

For the light source, two lasers are employed; a XeCl excimer laser operating at 308 nm and a Nd:YAG laser (with outputs at 355 nm, 532 nm and 1064 nm). Returns are generated by elastic (no change in wavelength) and Raman scattering, therefore two UV wavelengths are transmitted and four UV wavelengths are collected (the visible and near IR beams are used by NASA Langley to also measure aerosols).

Light backscattered from the transmitted wavelengths is collected by a 16” telescope. Wavelength separation is accomplished using beamsplitters and interference filters. The individual signals are amplified, discriminated, to reduce noise, and then recorded using both analog and photon counting electronics. Acquired data is stored with a temporal resolution of from 20 seconds to 2.5 minutes, and a vertical resolution of 15 – 150 meters.

Ozone is measured using the DIAL (differential absorption lidar) technique that employs two distinct wavelengths, one strongly absorbed by ozone (308 nm) and the other having minimal absorption (355 nm). Utilizing Raman signals permit the retrieval of ozone within aerosols and clouds.

Temperature profiles from just above the aircraft to beyond 60 km are retrieved using both Rayleigh and Raman scattering from the 355 nm transmitted radiation. Aerosol backscatter ratio is retrieved from the aircraft up to ~30 km. This also uses both elastic and Raman scattering in the UV.

After integration of signal to improve the SNR, the vertical resolution of the ozone and temperature measurements varies from 0.5 to 3 km depending upon range from the aircraft. The horizontal footprint varies from 4 to 40 km.

http://hyperion.gsfc.nasa.gov/Public/Ground_based/arotel/arotel.html